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Sockeye Salmon Escapement Estimation for the Alagnak River Drainage

Final Report for Study 00-031

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ABSTRACT

The recent decline in sockeye salmon runs to Bristol Bay has caused economic hardship and raised concerns among local subsistence users and federal managers. Setting, evaluating, and monitoring spawning escapement is the basis of sustainable salmon management. While most Bristol Bay sockeye salmon runs are adequately monitored, some escapement monitoring projects have been discontinued due to reductions in State funding. Counting tower operations on the Alagnak River, a major tributary of the Kvichak River, were discontinued in 1977. The counting site used for this study was about one mile upriver from the site used previously. Initial project funding was for counting in 2001 and 2002, but due to a shortened season in 2002, surplus funds were available and the tower was also operated in 2003. The project was intended to count chinook *Oncorhynchus tshawytscha*, sockeye *O. nerka*, chum *O. keta*, coho *O. kisutch*, and pink *O. gorbuscha* salmon. However, due to unfavorable counting conditions for chinook and coho and increases in field operating costs, the project goal shifted to concentrate on sockeye salmon. Total sockeye salmon passage estimates at the tower site were 615,114 in 2001, 766,962 in 2002, and 3,676,146 in 2003. Counting conditions were good in all years; however, the consistency and accuracy of 2001 counts may have been affected by several changes in field employees over the course of the season. Age composition information for all years was obtained from otoliths collected from carcasses sampled in four main spawning areas within the system: Kulik, Battle, Moraine, and Nanuktuk Creeks. Some scales for aging were collected from sockeye salmon passing the tower site in 2003, but high water conditions prevented sampling at the tower site in both 2001 and 2002. Bristol Bay Native Association, Alaska Department of Fish and Game, and National Park Service jointly developed this study in consultation with various local and regional organizations.

Key Words: sockeye salmon, *Oncorhynchus nerka*, spawning population, age and size information, counting towers, subsistence fishery, Alagnak River, Kvichak River, Bristol Bay, southwest Alaska.

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INTRODUCTION

The achievement of spawning goals is the primary management objective of Bristol Bay salmon fisheries management, since sufficient numbers of spawning salmon are needed to sustain these valuable resources and the fisheries that depend upon them. Accurate estimates of the total number of spawning salmon, along with age information, must be obtained each year to set and evaluate spawning goals. Daily, weekly, and total estimates of the number of salmon escaping commercial fisheries and entering freshwater drainages are used during the fishing season to make and assess harvest decisions. These decisions regulate commercial harvests in terminal fishing districts as well as sport and subsistence harvests in freshwater drainages.

Bristol Bay is the location of the largest sockeye salmon *Oncorhynchus nerka* runs in the world, and the run to the Kvichak River drainage is often the largest within Bristol Bay. While most Kvichak River sockeye salmon spawn and rear within Lake Iliamna and Lake Clark beaches and tributaries, the Alagnak River, which enters the Kvichak River several miles below the outlet of Lake Iliamna, also supports a sizeable run (Demory, Orrell, and Heinle 1964). The Alaska Department of Fish and Game has estimated the number of sockeye salmon migrating into the Lake Iliamna-Lake Clark system to spawn each year since 1957 using visual counts from towers installed on both riverbanks (Anderson 1999). However, tower counts of sockeye salmon entering the Alagnak drainage, also begun in 1957, were discontinued in 1977 due to cuts in the department's operating budget and because of poor counting conditions at the old, downriver site. Since that time, Alagnak River sockeye salmon escapement has been estimated each year using counts made from aerial surveys (Morstad 2002), and age information has been obtained by collecting otoliths from carcasses sampled in various spawning areas.

Recently, sockeye salmon runs to Bristol Bay have dramatically declined, and the Governor of Alaska declared Bristol Bay an economic disaster area in 1998. Reduced sockeye salmon runs have resulted in extensive commercial fishery harvest reductions and have also impacted subsistence and sport fisheries. While residents within Lake Clark have reported difficulty in meeting their subsistence needs for sockeye salmon, residents of Levelock, a community on the Kvichak River upriver of the mouth of the Alagnak River, have not reported similar problems. However, management agencies and local residents have recognized the need to better document and understand how sockeye salmon runs to Alagnak River are fluctuating in relation to runs to other portions of the Kvichak River drainage, particularly during this period of reduced production. While aerial counts might be providing a reliable index of relative abundance, resumption of Alagnak River tower counts would provide sockeye salmon escapement information that could be directly compared with Kvichak River tower counts. This information is needed to better understand the dynamics of the various sockeye salmon runs within the Kvichak River drainage as well as to better evaluate current production levels of Alagnak River sockeye salmon.

OBJECTIVES

1. Select a site appropriate for counting salmon escapement in the Alagnak River (2000).
2. Construct facilities for tower count, including towers (2001).
3. Hire seasonal staff (2001 and 2002).
4. Estimate escapement of sockeye, chinook, and coho salmon by tower counts (2001 and 2002).
5. Obtain age, sex, and length samples of salmon (2001 and 2002).
6. Conduct objectives 3-5 for an additional year (2003).

METHODS

A counting tower should be located (1) at a relatively narrow segment of a river where there is a single channel, (2) in an area where water clarity and depth allow visual identification and counting of salmon, and (3) where water currents induce salmon to swim close to shore and directly upriver rather than hold position, mill about, or spawn. Investigators initially surveyed the lower portion of the Alagnak River from an airplane, and followed this up with a survey from a boat to visit specific sites. These efforts included examination of the site used for past Alagnak River counting tower operations (Anderson 1999) in addition to other potential sites.

A two-year contract for the use of a parcel of land as a counting site, about one mile upriver from the original Alaska Department of Fish and Game tower site, was signed with the owner of Branch River Lodge in 2001. Included in the contract were room and board costs to house the counting crew at the lodge site. A new contract for a third year was signed in 2003, but increased costs made it necessary to shorten the season and focus on sockeye salmon.

To conduct the counting operation, two seasonal technicians were hired by the Bristol Bay Native Association and one seasonal technician was hired by the Alaska Department of Fish and Game. The department's employee served as the crew leader, although this person did not directly supervise the Bristol Bay Native Association's technicians. Specific duties and responsibilities under this arrangement were clearly defined to ensure field operations went smoothly.

Tower counting methods followed those used by the department at other sites within Bristol Bay (Anderson 1999). Each season, counting occurred for ten minutes of each hour on each side of the river. Separate counts were maintained for sockeye, chinook *O. tshawytscha*, chum *O. keta*, coho *O. kisutch*, and pink *O. gorbuscha* salmon. Hourly counts for each species were multiplied by six to estimate total hourly salmon passage, and total hourly passage estimates were accumulated to provide daily and cumulative passage estimates during the course of the season.

Counts were transmitted via radio or telephone to the Alaska Department of Fish and Game's King Salmon office each day. Age composition of the sockeye salmon run was estimated from samples of otoliths collected from sockeye salmon carcasses in four of the major spawning systems within the drainage: Kulik, Battle, Moraine, and Nanuktuk Creeks. Age composition of the 2001 Nanuktuk Creek spawning population, which was not sampled, was estimated from combined samples from Battle and Moraine Creek. This was done since past age composition estimates from Nanuktuk have been similar to these systems. Sockeye salmon could only be captured near the tower site for scale samples during 2003 since water levels and flows were too great in 2001 and 2002. Otoliths, scales, and supporting information were compiled in the field and sent back to the Alaska Department of Fish and Game's King Salmon office for analysis. Information sent to the Alaska Department of Fish and Game was shared with the U.S. Fish and Wildlife Service's subsistence fishery manager and the National Park Service's land manager for the portion of the Alagnak designated as a National Wild River. Information was also made available to Bristol Bay Native Association and the general public.

This was one of the first collaborative Fisheries Resource Monitoring Program studies jointly operated by the Alaska Department of Fish and Game, National Park Service, and Bristol Bay Native Association. It provided a good opportunity for a State agency, Federal agency, and local organization to jointly operate a fisheries study. During study planning and operations, consultations occurred with the Bristol Bay Regional Advisory Council, the Lake and Peninsula Borough, and various Bristol Bay villages, including Levelock.

The Bristol Bay Native Association recruited and hired local residents to fill both seasonal technician positions for this study. This allowed local residents to directly participate in collecting and analyzing information used to manage their subsistence salmon fishery resources. This work also allowed local residents to better understand the value and process of scientific decision making. All seasonal technicians hired were provided training in safety, field operations, data collection, and data analysis. This training and the experience gained from their work should increase their future employment opportunities with other fishery monitoring projects.

RESULTS AND DISCUSSION

In 2001, counting began on June 26 and ended 12:00 PM September 11 (Table 1). Total passage at the tower site, based on expanded counts, was estimated to be 1,146 chinook, 615,168 sockeye, 355,404 chum, 4,686 coho, and 534 pink salmon. Water level was high most of the season, but the water remained clear enough for counting on all days. Unfortunately, the high water made it impossible to capture salmon near the counting site for collection of age composition information. Therefore, staff flew into three of four main spawning areas (Kulik, Battle, and Moraine Creeks) on September 5 and collected 401 otoliths from sockeye salmon carcasses (Table 2). Aerial survey counts for these four creeks accounted for 267,000 sockeye salmon spawners, which was about 43% of the expanded tower count for the season. Overall,

five year old sockeye salmon (ages 1.3 and 2.2), the progeny of 1996 spawners, were most abundant in samples, comprising over 75% of samples from Kulik and Battle Creeks and about 47% of samples from Moraine Creek. Four year old sockeye salmon (age 1.2), the progeny of 1997 spawners, were second most abundant in samples, comprising almost 49% of samples from Moraine Creek and over 10% of samples from Kulik and Battle Creeks. Nanuktuk Creek was not sampled, but the spawning population age composition was assumed to be similar to Battle and Moraine Creeks.

Problems were encountered with recruiting and keeping seasonal technician positions filled for the duration of the field season. Only the person hired as the Alaska Department of Fish and Game's crew leader completed the entire season. Levelock Natives, Limited found it difficult to recruit local residents for Bristol Bay Native Association field crew positions. Furthermore, once hired, local residents usually only worked a few weeks before leaving, which meant that new employees had to be continually hired and trained to replace vacated positions. Project investigators are concerned that the consistency and accuracy of 2001 counts was compromised by the high turnover rate of the counting staff.

In 2002, counting began on June 28 and ended 12:00 PM July 22 (Table 3). Total passage at the tower site, based on expanded counts, was estimated to be 766,962 sockeye, 1,698 chinook, and 102,618 chum salmon. As occurred in 2001, water level was high most of the season, but the water remained clear enough for counting on all days. High water again made it impossible to capture salmon near the counting site for collection of age information, although attempts were made throughout the season. Therefore, staff flew into the four main spawning areas (Kulik, Battle, Moraine and Nanuktuk Creeks) on September 3 and collected 767 otoliths from sockeye salmon carcasses (Table 4). Aerial survey counts for these four creeks accounted for 335,661 sockeye salmon spawners, which was about 44% of the expanded tower count for the season. Overall, four year old sockeye salmon (ages 1.2 and 2.1), the progeny of 1998 spawners, were most abundant in samples, comprising about 37% (Kulik Creek) to 55% (Battle Creek) of samples. Five year old sockeye salmon (ages 1.3 and 2.2), the progeny of 1997 spawners, were second most abundant in samples, comprising about 44% (Battle Creek) to 57% (Kulik Creek) of samples.

No problems were encountered with recruiting and keeping seasonal technician positions filled for the duration of the field season. The person hired as the Alaska Department of Fish and Game's crew leader completed the entire season, and so did the two Bristol Bay Native Association's technicians.

In 2003, counting began on June 23, 2003 and ended 12:00 PM July 21 (Table 5). Total passage at the tower site, based on expanded counts, was estimated to be 3,676,146 sockeye, 2,712 chinook, and 43,860 chum salmon. High water was not a problem on the Alagnak River, unlike 2001 and 2002. Beach seining at several different locations allowed collection of scale samples from 812 sockeye salmon, though the desired minimum sample size was 1,400. Therefore, staff flew into the four main spawning areas (Kulik, Battle, Moraine and Nanuktuk Creeks) on August 29 and September 2 and collected 671 otoliths from sockeye salmon carcasses (Table 6). Aerial survey counts for these four creeks accounted for 2,110,000 sockeye salmon spawners, which was about 57% of the expanded tower count for the season. Overall, five year old sockeye

salmon (ages 1.3 and 2.2), the progeny of 1998 spawners, were most abundant in samples, comprising about 47% (Nanuktuk Creek) to 61% (Moraine Creek) of samples. Four year old sockeye salmon (ages 1.2 and 2.1), the progeny of 1999 spawners, were second most abundant in samples, comprising about 23% (Moraine Creek) to 47% (Kulik Creek) of samples.

As in 2002, no problems were encountered with recruiting and keeping seasonal technician positions filled for the duration of the field season. The person hired as the Alaska Department of Fish and Game's crew leader completed the entire season, and so did the two Bristol Bay Native Association's technicians.

Staff of the National Park Service, the Alaska Department of Fish and Game, and the Bristol Bay Native Association developed this study. During project planning, they met with other local organizations, villages, and residents to discuss issues relative to Alagnak River sockeye salmon, gain local support and approval for the work, and discuss job opportunities for local residents as technicians. Communications with local organizations and villages continued throughout the study to update them on study progress and findings as well as to recruit local residents for technician positions.

CONCLUSIONS

Since 2000 the total run of sockeye salmon to the Kvichak River system has been below established biological escapement goals of 6.0 million sockeye salmon in 2000 and 2.0 million for 2001 through 2003. However, the Alagnak River, a component of the Kvichak River system that flows into the lower portion of Kvichak River, has produced above average runs during this same three- year period. The State of Alaska has greatly restricted commercial salmon fishing to protect Kvichak River sockeye salmon stocks, which has allowed Alagnak stocks to pass through commercial fishing districts with little exploitation. Additionally, subsistence fishing effort on the Alagnak has declined, with only 51 sockeye salmon harvested in 2001 and 32 in 2002 (Alaska Department of Fish and Game 2002 and 2003). The reported subsistence harvest from the rest of the Kvichak River drainage was 32,857 sockeye salmon in 2001 and about 33,000 sockeye salmon in 2002 (Alaska Department Fish and game 2003). Based on escapements and harvests over the last three years, Alagnak River sockeye salmon stocks appear to be healthy.

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Table 1. Daily and cumulative expanded counts of salmon, Alagnak River, Bristol Bay, 2001.

Date	Chinook		Sockeye		Chum		Coho	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
6/26	0	6	804	804	0	0	0	0
6/27	42	48	13,482	14,286	54	54	0	0
6/28	0	48	12,198	26,484	6	60	0	0
6/29	0	48	4,626	31,110	18	78	0	0
6/30	6	54	2,970	34,080	6	84	0	0
7/01	0	48	5,580	39,660	0	84	0	0
7/02	0	48	6,204	45,864	0	84	0	0
7/03	0	48	5,622	51,486	0	84	0	0
7/04	6	54	3,666	55,152	0	84	0	0
7/05	6	60	12,072	67,224	6	90	0	0
7/06	0	60	29,094	96,318	6	96	0	0
7/07	6	66	22,836	119,154	12	108	0	0
7/08	6	72	43,872	163,026	0	108	0	0
7/09	0	72	53,976	217,002	6	114	0	0
7/10	6	78	91,710	308,712	0	114	0	0
7/11	0	78	157,086	465,798	12	126	0	0
7/12	0	78	20,520	486,318	18	144	0	0
7/13	12	90	8,274	494,592	120	264	0	0
7/14	6	96	5,664	500,256	378	642	0	0
7/15	18	114	3,018	503,274	240	882	0	0
7/16	54	168	16,056	519,330	756	1,638	0	0
7/17	60	228	28,830	548,160	12,510	14,148	0	0
7/18	48	276	7,134	555,294	13,338	27,486	0	0
7/19	18	294	3,654	558,948	7,470	34,956	0	0
7/20	0	294	19,242	578,190	7,206	42,162	0	0
7/21	36	330	9,984	588,174	11,298	53,460	0	0
7/22	0	330	5,574	593,748	7,296	60,756	0	0
7/23	12	342	2,052	595,800	2,358	63,114	0	0
7/24	48	390	3,456	599,256	3,252	66,366	0	0
7/25	192	582	5,958	605,214	19,842	86,208	0	0
7/26	84	666	4,602	609,816	16,404	102,612	0	0
7/27	72	738	1,428	611,244	14,916	117,528	0	0
7/28	144	882	1,536	612,780	18,372	135,900	0	0
7/29	78	960	960	613,740	14,898	150,798	0	0
7/30	6	966	630	614,370	8,334	159,132	0	0
7/31	30	996	168	614,538	2,268	161,400	0	0

-Continued-

Table 1. Continued.

Date	Chinook		Sockeye		Chum		Coho	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
8/01	48	1,044	324	614,862	27,858	189,258	6	6
8/02	0	1,044	156	615,018	14,484	203,742	0	6
8/03	54	1,098	54	615,072	15,942	219,684	0	6
8/04	0	1,098	30	615,102	10,500	230,184	0	6
8/05	0	1,098	12	615,114	22,080	252,264	0	6
8/06	0	1,098	0	615,114	11,154	263,418	0	6
8/07	0	1,098	30	615,144	6,342	269,760	18	24
8/08	0	1,098	18	615,162	21,954	291,714	78	102
8/09	12	1,110	0	615,162	15,840	307,554	222	324
8/10	6	1,116	0	615,162	10,374	317,928	66	390
8/11	6	1,122	0	615,162	5,826	323,754	96	486
8/12	0	1,122	0	615,162	6,960	330,714	378	864
8/13	0	1,122	0	615,162	5,076	335,790	294	1,158
8/14	0	1,122	0	615,162	3,270	339,060	132	1,290
8/15	0	1,122	0	615,162	2,286	341,346	138	1,428
8/16	0	1,122	0	615,162	6,756	348,102	444	1,872
8/17	6	1,128	0	615,162	1,542	349,644	120	1,992
8/18	0	1,128	0	615,162	372	350,016	66	2,058
8/19	0	1,128	0	615,162	576	350,592	42	2,100
8/20	6	1,134	0	615,162	1,236	351,828	78	2,178
8/21	0	1,134	6	615,168	1,218	353,046	138	2,316
8/22	0	1,134	0	615,168	558	353,604	36	2,352
8/23	0	1,134	0	615,168	558	354,162	60	2,412
8/24	0	1,134	0	615,168	234	354,396	96	2,508
8/25	0	1,134	0	615,168	270	354,666	270	2,778
8/26	0	1,134	0	615,168	246	354,912	258	3,036
8/27	0	1,134	0	615,168	90	355,002	222	3,258
8/28	0	1,134	0	615,168	42	355,044	150	3,408
8/29	6	1,140	0	615,168	0	355,044	96	3,504
8/30	0	1,140	0	615,168	42	355,086	192	3,696
8/31	0	1,140	0	615,168	30	355,116	144	3,840
9/01	0	1,140	0	615,168	72	355,188	108	3,948
9/02	6	1,146	0	615,168	48	355,236	120	4,068
9/03	0	1,146	0	615,168	36	355,272	72	4,140
9/04	0	1,146	0	615,168	12	355,284	48	4,188
9/05	0	1,146	0	615,168	6	355,290	156	4,344
9/06	0	1,146	0	615,168	18	355,308	78	4,422
9/07	0	1,146	0	615,168	6	355,314	90	4,512
9/08	0	1,146	0	615,168	12	355,326	60	4,572
9/09	0	1,146	0	615,168	24	355,350	42	4,614
9/10	0	1,146	0	615,168	30	355,380	54	4,668
9/11	0	1,146	0	615,168	24	355,404	18	4,686

Table 2. Estimated age composition of sockeye salmon spawning escapement from otoliths, Alagnak River drainage, Bristol Bay, 2001.

Drainage		Age Class Based on Otoliths							Total Otoliths	Aerial Survey Spawner Count
		1.1	1.2	2.1	1.3	2.2	2.3	1.4		
Kulik	Sample Size	1	12	0	75	2	8	4	102	85,000
	Sample %	0.98%	11.76%		73.53%	1.96%	7.84%	3.92%		
	Total Spawners	833	10,000		62,500	1,667	6,667	3,333		
Battle	Sample Size	2	32	0	151	5	8	1	199	46,500
	Sample %	1.01%	16.08%		75.88%	2.51%	4.02%	0.50%		
	Total Spawners	467	7,477		35,284	1,168	1,869	234		
Moraine	Sample Size	1	95	0	53	38	7	1	201	79,700
	Sample %	0.51%	48.72%		27.18%	19.49%	3.59%	0.51%		
	Total Spawners	710	67,474		37,644	29,990	4,972	710		
Nanuktuk ^a	Sample Size	3	69	0	295	11	21	1	400	55,800
	Sample %	0.75%	17.25%		73.75%	2.75%	5.25%	0.25%		
	Total Spawners	419	9,626		41,153	1,535	2,930	140		
Grand Total Spawners		2,116	41,774		196,035	6,749	16,620	3,707		267,000

^a System was not sampled, age composition estimated from combined samples for Battle and Moraine Creeks.

Table 3. Daily and cumulative expanded counts of salmon, Alagnak River, Bristol Bay, 2002.

Date	Chinook		Sockeye		Chum		Coho	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
6/28	0	6	5,832	5,832	0	0	0	0
6/29	30	36	20,934	26,766	12	12	0	0
6/30	24	60	24,522	51,288	12	24	0	0
7/01	12	72	23,616	74,904	48	72	0	0
7/02	72	144	75,150	150,054	612	684	0	0
7/03	60	204	57,312	207,366	258	942	0	0
7/04	30	234	30,606	237,972	294	1,236	0	0
7/05	54	288	45,054	283,026	4,134	5,370	0	0
7/06	36	324	48,432	331,458	2,022	7,392	0	0
7/07	12	336	33,048	364,506	300	7,692	0	0
7/08	12	348	45,966	410,472	702	8,394	0	0
7/09	12	360	49,116	459,588	450	8,844	0	0
7/10	18	378	26,514	486,102	636	9,480	0	0
7/11	0	378	19,200	505,302	2,802	12,282	0	0
7/12	54	432	100,452	605,754	5,538	17,820	0	0
7/13	48	480	43,752	649,506	1,506	19,326	0	0
7/14	60	540	27,594	677,100	1,662	20,988	0	0
7/15	72	612	17,688	694,788	5,604	26,592	0	0
7/16	324	936	11,736	706,524	18,216	44,808	0	0
7/17	330	1,266	9,042	715,566	17,238	62,046	0	0
7/18	192	1,458	4,860	720,426	9,312	71,358	0	0
7/19	30	1,488	9,828	730,254	3,312	74,670	0	0
7/20	42	1,530	18,468	748,722	7,554	82,224	18	18
7/21	54	1,584	11,892	760,614	7,674	89,898	60	78
7/22	114	1,698	6,348	766,962	12,720	102,618	90	168

Table 4. Estimated age composition of sockeye salmon spawning escapement from otoliths, Alagnak River drainage, Bristol Bay, 2002.

Drainage		Age Class Based on Otoliths							Total Otoliths	Aerial Survey Spawner Count
		1.1	1.2	2.1	1.3	2.2	2.3	1.4		
Kulik	Sample Size	6	65	0	93	6	3	2	175	74,500
	Sample %	3.43%	37.14%		53.14%	3.43%	1.71%	1.14%		
	Total Spawners	2,554	27,671		39,591	2,554	1,277	851		
Battle	Sample Size	1	111	0	73	16	1	0	202	69,100
	Sample %	0.50%	54.95%		36.14%	7.92%	0.50%			
	Total Spawners	342	37,971		240,972	5,473	342			
Moraine	Sample Size	1	95	0	53	38	7	1	195	138,500
	Sample %	0.51%	48.72%		27.18%	19.49%	3.59%	0.51%		
	Total Spawners	710	67,474		37,644	29,990	4,972	710		
Nanuktuk	Sample Size	1	84	2	48	53	7	0	195	53,561
	Sample %	0.51%	43.08%	1.03%	24.62%	27.18%	3.59%			
	Total Spawners	275	23,072	549	13,184	14,558	1,923			
Grand Total Spawners		3,881	156,189	549	115,391	49,575	8,514	1,562		335,661

Table 5. Daily and cumulative expanded counts of salmon, Alagnak River, Bristol Bay, 2003.

Date	Chinook		Sockeye		Chum		Coho	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
6/23	0	0	2,532	2,532	0	0	0	0
6/24	0	0	150	2,682	0	0	0	0
6/25	36	36	33,000	35,682	0	0	0	0
6/26	84	120	11,778	47,460	0	0	0	0
6/27	108	228	3,426	50,886	0	0	0	0
6/28	294	522	63,798	114,684	0	0	0	0
6/29	96	618	321,738	436,422	0	0	0	0
6/30	78	696	194,574	630,996	0	0	0	0
7/01	72	768	218,472	849,468	54	54	0	0
7/02	30	798	237,156	1,086,624	48	102	0	0
7/03	150	948	378,654	1,465,278	126	228	0	0
7/04	24	972	493,116	1,958,394	102	330	0	0
7/05	18	990	363,114	2,321,508	186	516	0	0
7/06	30	1,020	179,418	2,500,926	90	606	0	0
7/07	24	1,044	207,132	2,708,058	144	750	0	0
7/08	54	1,098	236,160	2,944,218	486	1,236	0	0
7/09	24	1,122	78,030	3,022,248	210	1,446	0	0
7/10	24	1,146	61,374	3,083,622	216	1,662	0	0
7/11	30	1,176	220,650	3,304,272	780	2,442	0	0
7/12	18	1,194	93,858	3,398,130	612	3,054	0	0
7/13	474	1,668	52,110	3,450,240	3,654	6,708	0	0
7/14	42	1,710	41,712	3,491,952	6,432	13,140	0	0
7/15	18	1,728	51,270	3,543,222	7,362	20,502	0	0
7/16	24	1,752	75,690	3,618,912	5,832	26,334	0	0
7/17	12	1,764	24,408	3,643,320	2,172	28,506	0	0
7/18	24	1,788	7,656	3,650,976	1,134	29,640	0	0
7/19	558	2,346	7,716	3,658,692	5,568	35,208	0	0
7/20	42	2,388	11,850	3,670,542	1,374	36,582	0	0
7/21	324	2,712	5,604	3,676,146	7,278	43,860	0	0

Table 6. Estimated age composition of sockeye salmon spawning escapement from otoliths and scales, Alagnak River drainage, Bristol Bay, 2003.

<i>Spawning Ground Samples</i>									
Drainage		Age Class Based on Otoliths							Aerial Survey Spawner Count
		1.1	1.2	2.1	1.3	2.2	2.3	1.4	
Kulik	Sample Size	2	46	0	47	1	0	2	98
	Sample %	2.04%	46.94%		47.96%	1.02%	0.00%	2.04%	
	Total Spawners	3,980	91,531		93,520	1,990	-	3,980	
Battle	Sample Size	1	58	1	100	15	18	0	193
	Sample %	0.52%	30.05%	0.51%	51.81%	7.77%	9.33%	0.00%	
	Total Spawners	1,202	69,720	6,716	120,207	18,031	21,637	-	
Moraine	Sample Size	2	42	4	91	29	28	1	197
	Sample %	1.02%	21.32%	2.03%	46.19%	14.72%	14.21%	0.51%	
	Total Spawners	13,431	282,061	26,863	611,132	194,756	188,041	0	
Nanuktuk	Sample Size	4	55	6	63	23	31	1	183
	Sample %	2.19%	30.05%	3.28%	34.43%	12.57%	16.94%	0.55%	
	Total Spawners	7,869	108,197	11,803	123,934	45,246	60,984	1,967	
Grand Total Spawners		26,482	551,508	45,382	948,794	260,023	270,662	5,947	2,110,000

<i>Alagnak Tower Samples</i>									
		Age Class Based on Scales							Total
		1.1	1.2	2.1	1.3	2.2	2.3	1.4	
	Sample size	1	140	0	424	60	85	9	719
	Sample %	0.14%	19.47%	0.00%	58.97%	8.34%	11.82%	1.25%	
	Total Tower Counts	5,113	715,800	-	2,167,852	306,772	434,593	46,016	3,676,146

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